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Facts about Serpentine Rock and Soil Containing Asbestos in California

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What is Serpentine?

The term “serpentine” refers to a group of minerals that make up serpentinite rock. “Serpentine” and “serpentinite,” however, are often used interchangeably. Serpentinite is a metamorphic rock formed when water and rock are exposed to low temperatures (about 400 to 600 °C) and metamorphic processes (high pressures) within the earth’s crust. Serpentinite is a type of ultramafic rock, consisting predominantly of magnesium silicate and iron oxide minerals.

Most ultramafic rocks, including serpentinite, contain naturally occurring asbestos (NOA) particles (fig. 1), microscopic needlelike particles of asbestos or asbestos-like fibers. The term “NOA” also refers to a group of relatively common fibrous minerals in rock (U.S. Geological Survey 2007). NOA minerals include chrysotile and fibrous forms of five amphiboles. These forms include a complex group of widely distributed magnesium-iron silicates (rock-forming minerals), crocidolite, amosite, anthophyllite, actinolite, and tremolite. The most common NOA particle in ultramafic rocks is chrysotile.



NOA particles are a known human health risk. Asbestos has been classified as a carcinogen by state, federal, and international agencies. If serpentinite or ultramafic rock is located on your property or was used to construct your driveway or walkways, there is a risk of asbestos exposure where you live.

HOW TO RECOGNIZE SERPENTINE LANDSCAPES

Serpentine is California’s state rock. The state contains over 1,988 square miles (3,200 sq. km) of serpentinite outcrops, and it is present in 42 of the 58 counties. It has a distinctive greenish-gray to bluish-black color and may have a waxy

Figure 1. Serpentine rock with veins of NOA. Source: U.S. EPA Naturally Occurring Asbestos Web site, <http://www.epa.gov/asbestos/pubs/clean.html>.



Figure 2. Serpentine bedrock exposed from road construction. Source: Doug Gearhart, Lake County Air Quality Management District.

or shiny appearance (fig. 2). Soils derived from serpentine support distinctive grasslands and chaparrals in many parts of central and northern California, especially in the Coast Ranges, the Klamath Mountains, and the Sierra foothills. Serpentine and ultramafic landscapes are best recognized by the stark contrast their vegetation type and density present compared with adjacent areas. Soils derived from serpentine and ultramafic rock support vegetation with low vigor and increased patchiness; they also contain more endemic species than do adjacent areas with soils derived from other rock types. Vegetation growing in soils derived from serpentine is often sparse or stunted because of low levels of calcium and high levels of magnesium, resulting in calcium deficiencies.

WHAT ARE THE HEALTH CONCERNS?

People may inhale or swallow dust containing asbestos fibers. These fibers can cause cancer and other diseases by remaining in the lungs or traveling to the lining of the lungs or the abdominal cavity. Twenty or more years may pass before symptoms of asbestos-related disease are observed. The two most common forms of cancer caused by long-term exposure to asbestos fibers are lung cancer and mesothelioma, a rare cancer

of the lining surrounding the lung, stomach, or heart. While smokers have an increased risk of lung cancer when exposed to asbestos, nonsmokers are also susceptible, and both groups are equally susceptible to mesothelioma.

NO “SAFE” LEVEL OF EXPOSURE TO ASBESTOS HAS BEEN ESTABLISHED

Any exposure to asbestos fibers involves some risk of disease. The level of risk depends on how often and to what degree one is exposed to asbestos fibers. No one knows how many fibers are needed to cause lung cancer or other diseases. Heavy and frequent occupational exposures are more likely to cause disease than are nonoccupational exposures; however, a lifetime of exposure to low levels is also recognized as a potential hazard.

Environmental health scientists have suggested that children have a higher risk of exposure than adults in the same environment due to their faster breathing rates, time spent outdoors, and greater time for disease to develop.

HOW ARE PEOPLE EXPOSED TO ASBESTOS FIBERS?

Individual asbestos fibers are so tiny they can be seen only with a microscope. Once disturbed, they may settle on the soil surface or become airborne. The risk associated with NOA particles in soils formed from serpentine or other rocks containing NOA is unclear. Soils contain a variety of aggregating agents such as organic matter, clay, iron oxides, and calcium carbonate. These constituents bind individual particles including NOAs into larger aggregates, which cannot be suspended in the atmosphere as dust and are less likely to reach the vulnerable areas of the lung. Soil disturbances that destroy soil aggregates and liberate individual particles or expose the parent rock to the atmosphere may increase the risk of exposure to NOA particles. Natural means and routine human activity that can expose or release dust that contains asbestos fibers may include

- disturbing dry soils, which can create dust that contains asbestos fibers
- exposing asbestos fibers to the soil surface by erosion from wind and water or through natural land movement
- storm water runoff, which can concentrate fibers that may become airborne when dried

- any form of mechanical exposure or disturbance of serpentinite bedrock

IMPROVEMENT OF EXISTING CONTROL MEASURES

On July 20, 2000, the California Air Resources Board (ARB) strengthened its asbestos airborne toxic control measures by eliminating the use of asbestos-containing serpentinite rock for surfacing operations, such as road covering or landscaping. Dr. Alan Lloyd, ARB chairman, stated, “This amendment improves the existing control measure and better protects the public from the cancer-causing effects of asbestos-laden dust from gravel roads, parking lots and landscaping” (California Air Resources Board 2000).

LIVING WITH SERPENTINE SOILS

Soils that form from serpentinite are an important natural resource in California. They support a wide range of unique and rare plant and animal life. Taking simple, common-sense precautions helps reduce the risk to residents who have serpentinite soils or rock on their property. Serpentine soils or rock should be left undisturbed and stabilized to reduce exposing or releasing fibers into the environment. As long as fibers remain bound in rock or soil, they pose very little health threat.

HOW CAN YOU AS A HOMEOWNER REDUCE YOUR EXPOSURE TO ASBESTOS DUST?

Avoid the following outdoor activities when serpentinite soil is dry and dusty:

- rototilling, digging, jackhammering, grading, or plowing
- using leaf blowers
- driving on unpaved roads or driveways
- riding horses or moving livestock
- construction or renovation activities that disturb the soil, such as pool installation

To control dust around your home, always

- presoak dry ground thoroughly before disturbing the soil
- use water to clean sidewalks and driveways
- avoid using (pave them over, if necessary) unpaved walkways, driveways, or roadways that may have asbestos-containing rock or soil

Landscaping can reduce exposure of asbestos fibers:

- To reduce natural erosion and dust, cover serpentinite soil with a layer of organic mulch or asbestos-free soil 3 to 6 inches (7.5 to 15 cm) thick. Plant gardens and yards with serpentinite-tolerant plants (see ANR Publication 8400, *Trees and Shrubs for Northern California Serpentine Landscapes*, <http://anrcatalog.ucdavis.edu/pdf/8400.pdf>).
- Provide adequate water until plants are well established.
- Keep heavily-trafficked areas moist.

Prevent fibers from entering the home:

- Asbestos fibers can be tracked into the home on shoes. Remove and clean shoes before entering the house.
- Fibers can settle on clothing. Wash exposed clothing separately from nonexposed clothing.
- Asbestos fibers can be transferred to family members by pets. Keeping pets in yards with grass or shrubs planted over bare soil can lower contact with soil and reduce tracking into the home. Where this is not possible, wash pets with running water from a hose following contact with bare soils.

If asbestos fibers may have been brought into the home:

- Avoid
 - dry-cloth dusting or feather dusting
 - sweeping or vacuuming
- Replace with
 - damp-cloth dusting or wet mopping
 - washable area rugs
 - HEPA filter vacuum.

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